PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2005/008709	16.03.2005	22.03.2004

International Patent Classification (IPC) or both national classification and IPC
INV. H01J37/32

Applicant
VARIAN SEMICONDUCTOR EQUIPMENT ASSOCIATES, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:

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Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ in written format

   ☐ in computer readable form

   c. time of filing/furnishing:

   ☐ contained in the international application as filed.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	3, 5-9, 15, 16, 19-33
	No:	Claims	1, 2, 4, 10-14, 17, 18
Inventive step (IS)	Yes:	Claims	15, 20, 22, 24, 25, 28-33
	No:	Claims	1-14, 16-19, 21, 23, 26, 27
Industrial applicability (IA)	Yes:	Claims	1-33
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V.

Reference is made to the following documents:

D1: US-A-5556501
D2: EP-A- 0810816
D3: US-A1-2003/0201722
D4: US-B1-6518190
D5: US-A-5540824
D6: US-A-6083363

1. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1, 2, 4, 10-14, 17, 18 is not new in the sense of Article 33(2) PCT.

1.1 Document D1 discloses (see col 7, lines 19-25; col. 21, lines 15-23 and 44-67; fig. 1, 2; the references in parentheses applying to this document):
A chamber (16B) that contains a process gas, the chamber having a chamber top (16A) comprising a first section (13) formed of dielectric material that extends in a first direction; a second section (17W) formed of a dielectric material that extends a height from the first section (13) in a second direction; and a top section (17S) formed of a conductive material that extends a length across the second section (17W) in the second direction; and a radio frequency antenna (30) that is positioned proximate the second section (17W) and that induces RF currents in the chamber (16A) that excite and ionize the process gas so as to generate a plasma in the chamber.
The subject-matter of claim 14 is therefore not new.

Document D2 also discloses (see col. 4, line 44 - col. 5, line 24; fig. 1, 2):
A chamber (25) that contains a process gas, the chamber having a chamber top (27) comprising a first section formed of dielectric material that extends in a first direction; a second section (26) formed of a dielectric material that extends a height from the first section in a second direction; and a top section (28) formed of a conductive material that extends a length across the second section (26) in the second direction; and a radio

frequency antenna (40) that is positioned proximate the second section (26) and that induces RF currents in the chamber (25) that excite and ionize the process gas so as to generate a plasma in the chamber.

1.2 Independent claim 1 discloses a plasma chamber corresponding to the chamber of claim 14, wherein the first section of the chamber top extends in a first *horizontal* direction and the second section in a second *vertical* direction.
In view of D1 (see fig. 1), the subject-matter of claim 1 is therefore not new.

1.3 Independent claim 17 discloses a method for generating a uniform plasma by using a plasma apparatus corresponding to the apparatus of claim 1, wherein the target to be treated is biased.
In view of D1 (see col. 8, line 66 - col. 9, line 4 and fig. 1), the subject-matter of claim 17 is not new.

1.4 Document D1 also discloses (see fig. 1) all the features of dependent claims 2, 4, 10-13, 18, which therefore are not new.

2. Dependent claims 3, 5-9, 16 do not contain any features which, in combination with the

features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step, the reasons being as follows:

- claim 3: a planar coil that is proximate to the first section is suggested by D3 (see fig. 8);
- claims 5-7: a coil around the second section and a planar coil adjacent the first section are suggested by D3 (see fig. 4, 8, 9);
- claims 8, 9: an additional coil not connected to the main coil is suggested by D4 (see col. 4, lines 24-38);
- claim 16: a chamber top, with first and second directions that are not orthogonal, is suggested by D5 (see fig. 2b, 2d).

3. Independent claim 19 discloses a method for generating a plasma corresponding to the method of claim 17, with the additional feature of an electromagnetic coupling between the RF currents induced through the first horizontal section and the second vertical section.
However, in an inductively coupled plasma reactor with a dome, the antenna system can have different configurations (see for example document D3, fig. 4, 8, 9). It would be obvious to the person skilled in the art to apply these features with corresponding effect to a method according to document D1 thereby arriving at a method according to claim 19.
The subject-matter of claim 19 is therefore not inventive (Art. 33(3) PCT).

3.1 Dependent claim 20 does not contain any features which, in combination with the

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the claim to which it refers, meet the req

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4. Independent claim 21 discloses a plasma source corresponding to the plasma source of claim 1, with the additional feature of an anode positioned in the chamber adjacent the top section.
However, these features have already been employed for the same purpose in a similar plasma apparatus (see document D6, col. 6, line 48 - col. 7, line 46 and fig. 1, 5). It would be obvious to the person skilled in the art, namely when the same result is to be achieved (control of the ion propagation), to apply these features with corresponding effect to a plasma source according to document D1, thereby arriving at a plasma source according to claim 21.
The subject-matter of claim 21 is therefore not inventive (Art. 33(3) PCT).

4.1 Dependent claims 23, 26, 27 do not contain any features which, in combination with the features of the claim to which they refer, meet the requirements of the PCT in respect of inventive step, for the following reasons:
- claim 23: the adjustment of the anode position to achieve a predetermined uniformity of the plasma is a normal practice for the skilled person;

- claims 26, 27: a showerhead anode, eventually connected to the ground is suggested by D6 (see col. 6, line 48 - col. 7, line 46).

5. The combination of the features of dependent claims 15, 22, 24, 25 is neither known from, nor rendered obvious to the skilled persons because these features are not suggested by the available prior art, i.e.:
   - claim 15: the first section is curved;
   - claim 22: the axial position of the anode is adjustable;
   - claim 24, 25: the constructional details of the anode.

6. Independent claim 28 discloses a method corresponding to the method of claim 21 for generating a plasma in a chamber corresponding to the plasma chamber of claim 1, with the additional features of an inductive coil placed on the first horizontal section and a second inductive coil placed in the second vertical section, and of an anode placed inside the chamber and biased in order to emit electrons.
   The combination of these features is neither known from, nor rendered obvious to the skilled persons b

y , t h e a v a i l a b l e p r i o r a r t .

The subject-matter of claim 28 is therefore new and inventive (Art. 33(2)(3) PCT).

6.1 Claims 29-33 are dependent on claim 28 and therefore they are new and inventive.

7. Additional remarks

7.1 The drawing reference signs should be indicated in the claims (Guidelines, 5.11).

7.2 The independent claims should be drafted in the "two-part" form (Guidelines, 5.05).

7.3 Present claim 14 includes all the technical features of present claim 1. Hence, this claim

should be reformulated as claim dependent on present claim 1 (Guidelines, 5.12).

7.4 Present claim 21 includes all the technical features of present claim 1. Hence, this claim should be reformulated as claim dependent on present claim 1.

7.5 Present claim 19 includes all the technical features of present claim 17. Hence, this claim should be reformulated as claim dependent on present claim 17.